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ABSTRACT

This scope and sequence guide, developed for a diesel mechanics vocational education program, represents an initial step in the development of a systemwide articulated curriculum sequence for all vocational programs within the Metropolitan Nashville Public School System. It was developed as a result of needs expressed by teachers, parents, and the business community for sequential structure within the vocational education curriculum. The guide contains an introduction, course description, general course objectives, course content (with specific objectives) in outline format, and a list of resource materials, such as textbooks, curriculum guides, and audiovisual aids. This three-year course of study begins with a presentation of the rules of safety and progresses to the use of tools and equipment in the diagnosis, service, and repair of diesel-powered equipment. The course covers diesel engines, transmissions, power trains, and accessory equipment. A unit of welding and machine shop is included. (KC)

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DIESEL MECHANICS

SCOPE AND SEQUENCE

VOCATIONAL EDUCATION

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Metropolitan Public Schools

Nashville Davidson County, Tennessee

Charles O. Frazier, Director

FOREWORD

This scope and sequence guide, developed for the Diesel Mechanics Vocational Education program, represents an initial step in the development of a systemwide articulated curriculum sequence for all vocational programs within the Metropolitan Nashville Public School System. It is a direct result of needs expressed by teachers, parents, and the business community for sequential structure within the vocational education curriculum. An articulated vocational curriculum allows a student to move from one level of instruction to the next without repeating learning tasks already mastered, and without experiencing gaps in the presentation of relevant instructional material.

A goal of this curriculum effort is to provide teachers a usable guide based on input from the teachers. The initial step was an identification of course content, with all teachers having an opportunity to contribute. What follows is a publication using the teachers' contributions: a sequential listing of objectives and skills for each program offering.

This guide does not include all specific resource materials that may be used to assist students in acquiring minimum competencies. It is to serve as a guide for the sequence of course content and scope of what is to be taught. This guide content is extremely important and its use is encouraged. The suggested competencies and resource materials allow instructors an opportunity to be creative and resourceful in meeting the needs of individual programs and students.

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INTRODUCTION

The use of diesel engines as a source of power is widespread and increasing at a rapid rate. Diesel engines are used in cars, trucks, buses, trains, ships and boats. They are used in tractors, harvesters and self-propelled equipment in farming. In mining and construction, they power bulldozers, earthmovers, backhoes, cranes and trenchers. Generators, compressors and other stationary equipment use diesel for power.

The increasing use of diesel engines offers many opportunities for career development, with good pay in all areas. Some of these areas are: sales, new and used equipment, service, service management, machine shop, parts sales, shop management, diesel instruction and fleet service management.

This guide is offered as a solid foundation upon which an instructional program can be developed, hopefully preparing the student for the world of work and a most rewarding career.

COURSE DESCRIPTION

The diesel engine course is presented in a simple, straightforward manner. It begins with the presentation of rules of safety and progresses to the use of tools and equipment in the diagnosis, service and repair of diesel powered equipment.

The course covers diesel engines, transmissions, powertrains and accessory equipment. A unit of welding and machine shop is included.

GENERAL COURSE OBJECTIVES

1. To develop an awareness of the careers available and the preparation necessary to be proficient in each career
2. To stress the importance of working safely in a relatively unsafe environment
3. To develop a working knowledge of the use and care of tools and precision equipment used in the service of diesel powered machinery
4. To lay a foundation, based on generally accepted practice, of service and repairs for diesel powered equipment
5. To introduce the students to the importance and practice of welding and metal fabrication as used in the diesel trade

COURSE CONTENT FOR DIESEL MECHANICS I

(First Semester)

I. Orientation (12 weeks)

Specific objectives:

To give a brief history of development of the diesel engine
To understand the safe rules of conduct in the shop
To understand the use of basic tools, test equipment and fasteners

A. Completes all forms relative to class, assigned work lockers and safety apparel to be worn in shop

B. Becomes oriented to diesel mechanics

1. History
2. Development
3. Application
4. Job placement
5. Student knowledge requirement for employment
6. Films and slides concerning diesel uses
7. Field trip to local truck dealership

C. Understands the importance of shop safety

1. Shop safety rules
2. Safety film
3. Shop equipment demonstration (relative to safe operation)
4. Instruction: basic first aid (Metro Fire Dept. instructor)
5. Safety test: 100% score necessary to work in shop
6. Safety pledge

I. **Orientation continued:**

D. Becomes familiar with and uses basic shop tools

1. Hand tools
2. Precision tools
3. Proper tools

E. Becomes familiar with and uses test equipment and service tools

1. Engine dynometer
2. Machine calibrating
3. Injector comparator and pop tester
4. Cummins and Detroit Diesel timing tools

F. Becomes familiar with and uses fasteners in auto/diesel repair

1. Types
2. Application
3. Strength standards

II. **Operating principles (6 weeks)**

Specific objectives:

To understand the operating principles of a diesel engine
To determine the type fuel and lubricant needed to service the engine
To determine the condition of the coolant and cooling system
To understand the function of bearing and seals

A. Understands engine operating principles

1. Four stroke
2. Two stroke

B. Classifies diesel fuels and lubricants

1. Characteristics
2. Methods of selection

II. **Operating principles continued:**

C. Demonstrates knowledge of cooling systems and coolants

1. Radiators
2. Heat exchangers
3. Oil coolers
4. Inter and after coolers
5. Field trip to radiator rebuild shop

D. Reviews for mid-term examination

COURSE CONTENT FOR DIESEL MECHANICS I

(Second Semester)

I. **Operating principles (3 weeks)**

Specific objectives:

To understand operating principles of a diesel engine
To determine type fuel and lubricant needed to service the engine
To determine condition of the coolant and cooling system

A. Understands principles of operation of a diesel engine

B. Services the full system

C. Diagnoses the cooling system

II. **Engine components (15 weeks)**

Specific objectives:

To check and service diesel cylinder head assembly
To inspect and service valves
To inspect and repair block assembly
To understand function of bearings and seals

A. Completes cylinder head assembly

1. Pressure test
2. Valves, seats and crossheads
3. Injector tubes

B. Develops piston and rod assembly skills

1. Piston and rod removal from block
2. Piston - clean and inspect
3. Rod - rebuild (field trip to machine shop)
4. Piston and rod - fit and reassemble
5. Piston and rod installation

II. **Engine components continued:**

C. Demonstrates camshafts, gear train and engine timing skills

1. Cam bearing removal and installation
2. Cam inpsection and measurement
3. Cam and valve design
4. Gear train inspection and fitting
5. Use of degree wheel
6. Cummins timing tool
7. Mack, Caterpillar and Detroit timing

D. Demonstrates cylinder block service skills

1. Block cleaning
2. Line boring
3. Block surface planing
4. Liner counterbore repair
5. Liner installation and measurement
   a. Dry
   b. Wet

E. Services crankshaft and bearings

1. Inspection
2. Parts - clean and store
3. Magaflux
4. Straightening and grinding
5. Installation
6. Field trip to machine shop

II. **Engine components continued:**

F. Understands function of bearings

1. Plain bearing
2. Tapered roller
3. Ball
4. Thrust

G. Understands function of seals

1. Leather seals
2. Neoprene-double lipped
3. Stemco oil seals

H. Reviews for final examination

COURSE CONTENT FOR DIESEL MECHANICS II

(First Semester)

I. Auxiliary systems (12 weeks)

Specific objectives:

To understand function of the lube system
To test and service oil coolers
To test and service intercoolers, starters and engine brakes

A. Understands lubrication systems

1. Lube pumps
2. Oil coolers
3. Oil filters
4. Lube oil lines
   a. Metal
   b. Stratoflex

B. Services and/or repairs air intake and exhaust systems

1. Supercharger and turbocharger
2. Exhaust manifolds, mufflers and pipes
3. Air cleaners
   a. Dry
   b. Wet

C. Services and/or repairs starting systems

D. Services and/or repairs charging system

E. Understands and services types of engine brakes and retarders

1. Jake brake

1. Jake brake continued:

   a. Wiring

   b. Detroit engine

   c. Cummins engine

   d. Mack engine

2. Brakesaver

II. Engine performance (6 weeks)

Specific objectives:

To install engine in test bed
To tune and adjust under operating conditions
To diagnose problems and rate engine by use of dynometer
To prepare engine for storage

A. Learns operation and maintenance procedures

   1. Filters

      a. Fuel

      b. Oil

      c. Air

B. Acquires diagnostic and testing skills

   1. Dynometer

   2. Manometer

   3. Performance test

C. Reviews for mid-term examination

COURSE CONTENT FOR DIESEL MECHANICS II

(Second Semester)

I. **Engine performance (7 weeks)**

Specific objectives:

To install engine in test bed
To tune and adjust under operating conditions
To diagnose problems and rate engine by use of dynometer
To prepare engine storage

A. Tunes and adjusts engine

1. Cummins valves and injectors
2. Mack valves and injectors
3. Detroit valves and injectors

B. Prepares engine for storage

1. Temporary
2. Permanent

II. **Welding (including welding project) (11 weeks)**

Specific objective:

To be able to weld a project

A. Learns arc welding

1. Flat
2. Vertical

B. Learns oxyacetylene cutting

C. Learns oxyacetylene fusion welding

D. Plans and constructs project

E. Completes final semester examination

COURSE CONTENT FOR DIESEL MECHANICS III

(First and Second Semesters)

I. Clutch (2 weeks)

Specific objectives:

To learn to identify the types of clutches
To diagnose and service clutch malfunctions

A. Learns to identify, diagnose and service pull type clutches

B. Learns to identify, diagnose and service push type clutches

C. Learns to identify, diagnose and service single disc clutches

D. Learns to identify, diagnose and service twin disc clutches

II. Transmission (16 weeks)

Specific objectives:

To be exposed to components of transmissions
To develop the ability to service and repair transmissions

A. Services and repairs single countershaft transmissions

1. 4 speed Clark
2. 5 speed
3. Overdrive

B. Services and repairs twin countershaft transmissions

1. Fuller roadranger
   a. 5 speed
   b. 10 speed
   c. 13 speed
2. Spicer

2. Spicer continued:

a. 6 speed

b. 9 speed

3. Mack

a. Duplex

b. Triplex

c. Quadraplex

C. Services and repairs differentials and drive axles

1. Single speed

2. Two speed

3. Power divider

4. Wheel reduction units

D. Services and repairs torque converter

III. Equipment repair (18 weeks)

Specific objective:

To develop skill in the repair of diesel equipment

A. Inspects and determines needed repairs

B. Repairs diesel engines

C. Services and repairs diesel accessory components

IV. Job interview (graduating seniors only)

Specific objective:

To prepare for entrance into job market

A. Makes contact with local service managers

B. Prepares resume'

IV. **Job interview continued:**

C. Makes job application

D. Participates in instructor follow up

RESOURCE MATERIALS

Textbooks

Burdy, Robert N. Diesel Fuel Systems. Reston, Virginia: Reston Publishing Company, 1981.

Schulz, Erich J. Diesel Mechanics. Burnaby, British Columbia: McGraw-Hill Publishers, 1977.

Thiessen, Frank and Davis, Dales. Diesel Fundamentals, Principles and Service. Reston, VA: Reston Publishing Company, 1982.

Tolboldt, Bill. Diesel Fundamentals, Service, Repair. South Holland, Illinois: Goodheart-Wilcox Publishers, 1983.

Curriculum Guides

Automotive Mechanics Competency Based Curriculum. Nashville, Tennessee, Tennessee Department of Education, Vocational Section, 1981.

Diesel Engine Mechanics. MAVCC, Stillwater, Oklahoma, 1982.

Hydraulics. MAVCC, Stillwater, Oklahoma, 1982.

Audio Visual

Films

"Checklist Safety", Cummins Engine Co., Columbus, Indiana, (20 minutes)

"Trial by Speed", Cummins Engine Co., Columbus, Indiana, (25 minutes)